A contextual profile of club drug use among adults in Chicago

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ABSTRACT

Aims To better understand the prevalence, correlates, risk factors and context of club drug use among US adults in the City of Chicago.

Design An Audio Computer-Assisted Self Interview was administered to a household probability sample of adults, aged 18–40 years, from June 2001 to January 2002.

Setting Subjects were drawn from randomly selected households using a multi-stage area probability design.

Participants The data represent 627 randomly selected adult participants.

Measurement Weighted prevalence estimates with design-effect adjusted confidence intervals of life-time, past 12 month and past 30 day use of any club drug and of specific club drugs; prevalence of rave attendance, other drug use, motivation for use among club drug users; χ^2 tests of significance, logistic regression and adjusted odds ratios.

Findings Overall club drug prevalence rates were nearly twice those obtained for MDMA alone. Club drug users were more likely to use multiple illicit substances and to report having been in treatment for substance use. A majority of life-time club drug users never attended a rave although rave attendees were more likely to report frequent use of MDMA. Use was associated with gender, race and sexual orientation.

Conclusions Prevention research should be informed by further population-based research on club drug use. Research should not focus exclusively on rave attendees, as they are only a subset of club drug users. Research is needed on neurological and behavioral sequelae across different types of club drugs, gender differences in the impact of sexual orientation on club drug risk and on the effects of personality characteristics such as sensation seeking on club drug use behavior.

KEYWORDS Club drugs, epidemiology, MDMA, substance abuse, survey research.

INTRODUCTION

Over the past decade, 'club drugs', which include such substances as methylenedioxymethamphetamine or MDMA (ecstasy), ketamine, Rohypnol and GHB have emerged as major substances of abuse among young adults. The design of campaigns targeted toward minimizing the consequential harm resulting from their use requires an adequate understanding of the prevalence, correlates and risk factors associated with this behavior. In recent years, major US national surveys have suggested trends towards sharply increasing MDMA use among high school and college-aged youth [1–5].

Major US national surveys such as the National Household Survey on Drug Abuse (NHSDA) and the Monitoring the Future (MTF) study track general trends regarding MDMA use for the country as a whole. Nevertheless, these large-scale surveys may be of limited utility in understanding club drug prevalence for several reasons. Club drugs show considerable regional variability

[2,6] and the major national surveys do not facilitate comparisons regarding local trends. Secondly, these surveys have inquired about a limited range of club drugs, focusing mainly on MDMA and LSD, virtually ignoring other drugs which are associated with the club scene, such as ketamine and GHB. Thirdly, major national surveys have not inquired about the details and context of club drug use. In particular, they provide little data regarding the frequency of ingestion of these substances. These studies also fail to provide data about respondent participation in raves, clubs or circuit parties, i.e. venues that are linked specifically to club drug use and other risky behaviors. In contrast, those studies that have focused on one or more of these critical contextual issues, while providing valuable preliminary insights, are limited because they have employed non-probability convenience samples obtained mainly from outside the United States [7–13]. Two recently published US studies employing probability samples focus on limited populations such as college students [5] and gay men [14]. A third US study employed a convenience sample of rave attendees [15].

One potential nexus of club drug harm stems from a potential association between club drug use and high-risk sexual behavior. The disinhibiting effects of club drugs have been examined via journalistic observations and interviews [16,17] as well as in qualitative research studies [18]. Media accounts have presented possible linkages between club drug usage in general and MDMA, in particular, and increased sexual activity and unsafe sex practices [16,17]. These accounts have been mirrored in summaries provided in at least one government-sponsored website [19].

Researchers have provided some empirical evidence supporting these linkages. Klitzman and colleagues [14] found that MDMA use was associated strongly with a history of recent unprotected anal intercourse among gay and bisexual men. Interviews of MDMA users conducted by Beck & Rosenbaum [18] suggested that MDMA use enhances sensual pleasure but not sexual arousal. Peugh & Balenko [20] note that other club drug substances, such as GHB, have been used to facilitate date rape. These same researchers note that methamphetamine has been linked to increased sexual arousal and high-risk sexual behaviors including gay males' increased willingness to participate in repeated episodes of receptive anal intercourse.

The present study is an attempt to understand these issues further within the context of a general population survey. Specifically, we describe prevalence, correlates and risk factors associated with club drug use from a recently completed probability sample of Midwestern urban adults. We examine whether local Chicago estimates regarding MDMA use correspond with national estimates. While this study provides specific information about MDMA prevalence, our definition of relevant substances includes the full constellation of substances considered in the club drug category by the National Institute on Drug Abuse: MDMA, GHB, Rohypnol, ketamine, methamphetamine and LSD [21]. This study is based on one of the few up-to-date probability surveys regarding the context of club drug use by young adults. The survey included questions about specific club drugs used, frequency of their use, source of club drug procurement, as well as the location of and motivation for their use.

METHODS

Sample

Data used for this study came from a survey of English-speaking adults who resided in the City of Chicago. The survey was conducted from June 2001 to January 2002. Residents between the ages of 18 and 40 years were selected randomly to participate in a household drug use survey using a multi-stage area probability design [22]. At stage 1, census tracts in Chicago were selected randomly. At stage 2, one block was selected randomly from within each sampled tract. At stage 3, every household on the sampled block was screened for eligibility. At stage 4, one 18–40-year-old adult was selected at random from within each eligible household [23]. Surveys were administered in the home by trained interviewers from the University of Illinois at Chicago Survey Research Laboratory using Audio Computer Self-Interview (ACASI) procedures. Although the vast majority of subjects (90%) self-administered the substance use questions, subjects could also opt to have their questions administered by the interviewer. The study was approved by the University of Illinois at Chicago Institutional Review Board.

A total of 627 surveys were completed. We used American Association for Public Opinion Research [24] definitions for response rates (formula 3) and cooperation rates (formula 1). According to this definition, the response rate is the number of completed interviews divided by the eligible sample. The cooperation rate is the number of completed interviews divided by the sum of the number of completed interviews and the number of refusals. Note that because those in the eligible sample include potential subjects who were never contacted by the interviewers despite repeated attempts, the response rate tends to be lower than the cooperation rate. The overall response and cooperation rates for this study were 40% and 74%, respectively. These rates reflect the challenges of conducting survey interviews in urban environments, where response rates tend to be lower for many reasons [25]. When restricted-access, high-rise apartment buildings are excluded from consideration, the comparable

response and cooperation rates were 51% and 75%, respectively.

Demographic characteristics of participants

Using unweighted sample estimates, 38.9% of the sample were between ages 18 and 25, 26.2% were between the ages of 26 and 30, and 34.9% were over 31 years (with the maximum age of 40 years). African Americans comprised the modal race/ethnicity group, comprising 40.6% of all respondents; just under one-third (32.0%) were white, 18.2% were Hispanic and 9.2% were classified as 'other'. The majority of subjects (61.4%) were women. We measured socio-economic status (SES) as a composite additive indicator of responses to questions about income, education and employment status (Cronbach's alpha = 0.68); subjects were classified as 'high', 'medium' or 'low' based on an inspection of the empirical distribution of this variable. Accordingly, just over one in five (22.1%) were classified into the 'low' group, just under half (46.3%) were in the 'medium' group and just under one-third (31.6%) were in the 'high' group. Just over half of the respondents (53.3%) reported having children in the household and over three-quarters (78%) were single.

Drug use assessment

The drug use portion of the survey was administered on laptop computers using ACASI technology. The substance use questions were similar to those used in the National Household Survey on Drug Abuse (NHSDA). Respondents were asked about their life-time and most recent substance use, age of first use and frequency of use. Substances asked about included tobacco, alcohol, marijuana, cocaine, crack, heroin, hallucinogens, inhalants, stimulants, tranquilizers, sedatives and pain relievers. A separate module (see below) focused specifically on details surrounding club drug use. After the drug use portion of the survey was completed, respondents were asked to submit hair, oral fluid and urine samples for analysis and were offered either $10 or $20 for each sample provided, depending on random assignment. Drug testing screened and confirmed for the presence of four classes of drugs that included cocaine, marijuana, opiates and amphetamines. It should be noted that the testing was of limited utility regarding the presence of club drugs, as only three subjects were positive for club drugs (two were positive for MDMA and one for ketamine). Of these three subjects, one admitted to recent club drug use and two to life-time club drug use. While this suggests that under-reporting of club drugs could possibly be a problem, this low rate of detection suggests that testing has limited utility for club drug screening in this sample; therefore, we present data based completely on the self-report responses provided in the survey.

Club drugs assessment

The club drug section asked specifically about several club drugs including ecstasy (MDMA), ketamine, Rohypnol, GHB, methamphetamine and LSD. Respondents read the following at the beginning of the section:

> The next set of questions refer to substances sometimes taken at dance parties, which are called 'raves' 'circuit parties' or 'trances'. These substances are sometimes called 'club drugs'. We are interested in *any* time you might have used these drugs, whether at a dance party or not.
>
> A list of some common club drugs is shown on the next page. These and other substances that people use as club drugs are often known by street names, and we cannot list them all. Please take a moment to look at the substances listed so you know what kind of drugs the next questions are about.
>
> MDMA, also called 'ecstasy', XTC, X, Adam, Clarity, Lover's Speed
>
> GHB, also called Grievous Bodily Harm, G, Liquid Ecstasy, Georgia Home Boy, Liquid G
>
> Ketamine, also called, K, Special K, Vitamin K, Cat Valiums
>
> Rohypnol, also called Roofies, Rophies, Roche, Forget-me Pill
>
> Methamphetamine, also called Speed, ice, chalk, meth, crystal, crank, fire, glass
>
> LSD, also called 'acid', boomers, yellow sunshines

Respondents who reported any life-time club drug use were also asked about when and where they last used the substances, where they obtained the substances and what substances they used along with the club drug(s).

A separate question asked those who admitted to club drug use about their rave attendance history:

> Have you ever attended an all-night dance party such as a 'rave', 'circuit party' or 'trance?

Respondents indicating rave attendance were then asked details about their substance use at the last rave attended.

Note that detailed questions about two specific substances (MDMA and LSD) overlapped with other sections of the survey. Because several cases were inconsistent with respect to their responses on these other substances, subjects were classified as club drug users for prevalence purposes if they indicated use in either section. Details about the context of club drug use are available only for those subjects who disclosed such use in the separate club drug section.

Table 1 Weighted club drug use prevalence ($n = 627$).[1]

	Life-time			*Past 12 months*			*Past 30 days*		
95% CI	n	%	*95% CI*	n	%	*95% CI*	n	%	*95% CI*
Any club drug	127	21.7	15.9, 28.8	26	5.1	3.0, 8.6	3	0.5	0.1, 1.6
MDMA	55	9.6	6.4, 14.2	17	3.0	1.6, 5.4	2	0.3	0.0, 1.6
GHB	6	1.1	0.5, 2.5	0	0.0	–	0	0.0	–
Ketamine	7	1.3	0.6, 2.7	1	0.2	0.0, 1.8	1	0.2	0.0, 1.8
Rohypnol	3	0.6	0.1, 2.6	0	0.0	–	0	0.0	–
Methamphetamine	43	6.7	4.9, 9.2	4	0.6	0.2, 1.7	1	0.2	0.0, 1.8
LSD	99	16.7	12.4, 22.2	11	3.0	1.4, 6.3	2	0.4	0.0, 1.6

[1]Post-stratification weights were applied to derive prevalence estimates; confidence intervals were generated using STATA Svytab procedures (StataCorp, 2001).

Analyses and comparisons are provided in an unweighted format, with one exception. For prevalence estimates, poststratification weights were applied to adjust for differences in demographic distributions between the sample and 2000 census data. Weighted prevalence estimates (using poststratification weights; see Lohr [26]) along with confidence intervals adjusted for design effects were calculated using the Stata Svytab procedure [27].

RESULTS

Table 1 lists the life-time, past 12 months and past 30-day prevalence of club drug use for the entire sample. The life-time prevalence of any club drug use was 21.7%. The most commonly reported club drugs were LSD (16.7%), MDMA (9.6%) and methamphetamine (6.7%). A similar pattern emerged for recent use. Five per cent of the sample reported some club drug use in the past year and 3% reported ecstasy or LSD use. Past month use was a rare occurrence in the sample. Less than 1% (0.5%) reported any club drug use in the last 30 days. It is worth noting that despite media attention focusing on MDMA as a major club drug, our local survey found that this substance was comparable both in terms of life-time and recent prevalence to LSD.

We compared data from our Chicago-based survey with club drug prevalence described in two recently completed national surveys, the 2000 NHSDA [3] and 2001 MTF [1]. Reflecting the limited scope of assessment noted above, these comparisons focus specifically on the major club drug assessed in these other studies, MDMA. In addition, our prevalence comparisons construct age-specific prevalence rates corresponding with age ranges covered by these two surveys in available publications (19–32 and 26–34 for MTF and NHSDA, respectively). Figure 1 suggests fairly similar rates generated across surveys. Our Chicago study yielded rates that are slightly elevated compared to those in the MTF study and compared to the 26–34-year-old age group in the NHSDA. Nevertheless, it should be noted that the MTF and NHSDA point estimates for each comparison fall within the relevant confidence bounds generated from the Chicago study. Of course, our overall extent of club drug use increases considerably when other substances not generally assessed in these other surveys are considered.

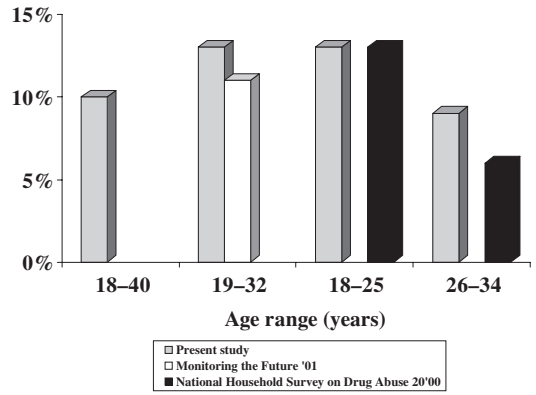

Figure 1 Age-specific MDMA weighted prevalence rates by study

Table 2 Club drug use frequency.

	Life-time	*Used 10 + times*	*No. of times used*	
	n	%	*Median*	*Range*
MDMA	50	36.0	3.0	1–250
GHB	6	16.7	2.2	1–15
Ketamine	7	14.3	1.0	1–100
Rohypnol	3	33.3	1.0	1–500
Methamphetamine	43	46.5	5.0	1–400
LSD	96	44.8	5.5	1–200

Club drug use details and context

Use frequency

Table 2 describes the frequency with which life-time club drug users reported using different types of club drugs.

Inspection of the neurophysiological literature suggests that subjects who use club drugs on multiple occasions may be at increased risk for lasting executive performance deficits. [28–30] Accordingly, we examined the percentage of users of each substance who reported use on 10 or more occasions as well as the median number of use occasions for each substance. The median number of use occasions for each substance does not approach this high risk level for any particular club drug, suggesting that most club drug using subjects in our survey may have been experimental users. Nevertheless, a sizable proportion of MDMA (36%), Rohypnol (33%), methamphetamine (47%) and LSD (45%) users report using these substances 10 or more times. The extremely wide range of use frequencies for nearly all the club drugs should also be noted. While extremely high frequency use of these substances was rare, at least some users of MDMA, rohypnol, ketamine, methamphetamine and LSD reported using these substances on hundreds of occasions.

Behavior during last club drug consumption

Contextual issues surrounding club drug use were assessed further by a set of questions regarding behavior during subjects' 'last' use occasion. This information is summarized in Table 3. Of the 125 respondents who provided details about their last club drug use occasion, nearly three-quarters (73%) reported using at least one other substance when they last used a club drug. Nearly 18% reported using three or more substances. The most common other substances used were alcohol (58%), marijuana (54%) and cocaine/crack (22%). Despite being called 'club drugs', nearly half reported that their last use was either at a 'friend's home' (38%) or their own home (10%). Slightly more than one-quarter (26%) reported last using club drugs in a bar, club or at a dance party or rave. Finally, when asked about the source of their club drugs last used, again few subjects (8%) indicated that the source was a venue (including a club, dance or 'private party') itself. Most (73%) identified the source as a 'friend or a partner'. The next most common source for the club drugs was a 'drug connection' (11%).

Table 3 Behavior during last club drug use.

	n	%	95% CI
Number of other substances also used when last used CD[1] (*n* = 125)			
None	34	27.2	20.0, 35.8
1 other drug	31	24.8	17.9, 33.2
2 other drugs	39	31.2	23.6, 40.0
3 or more other drugs	21	16.8	11.1, 24.5
Drugs used with CD			
Alcohol (*n* = 123)	71	57.7	48.7, 66.3
Marijuana (*n* = 123)	66	53.7	44.7, 62.4
Cocaine/crack (*n* = 124)	27	22.0	15.4, 30.3
Heroin (*n* = 124)	6	4.8	2.2, 10.5
Amphetamines (*n* = 124)	7	5.7	2.7, 11.5
Others (*n* = 124)	5	4.0	1.7, 9.4
Where last used CD (*n* = 121)			
Venue			
Circuit/rave/dance party	12	9.9	5.7, 16.8
Dance club or party	13	10.7	6.3, 17.8
Bar	7	5.8	2.8, 11.8
Home	12	9.9	5.7, 16.8
Friend's home	46	38.0	29.7, 47.1
Park	7	5.8	2.8, 11.8
Street	6	5.0	2.2, 10.7
Car	1	0.8	0.1, 5.8
Concert	5	4.1	1.7, 9.7
Other	12	9.9	5.7, 16.8
Where last obtained CD			
Club or bar	3	2.5	0.8, 7.5
Circuit/rave/dance party	5	4.1	1.7, 9.7
Private party	2	1.7	0.4, 6.5
Drug connection	13	10.7	6.3, 17.8
Friend or partner	88	72.7	64.0, 80.0
On street	5	4.1	1.7, 9.7
Internet	1	0.8	0.1, 5.8
Other	4	3.3	1.2, 8.6

[1]Includes alcohol, marijuana, cocaine/crack, heroin, PCP, hallucinogens (excluding LSD and XTC), stimulants (excluding methamphetamine), tranquilizers and sedatives.

Rave-related behavior

Table 4 tracks rave-related behavior in greater detail. Specific rave-related behavior was assessed by asking life-time club drug users if they had 'ever attended an all-night dance party such as a "rave," "circuit party" or a "trance"'. Forty-seven respondents (38%) who had used club drugs had ever attended such an event (henceforth referred to as a "rave"); 34% of those respondents had attended a rave in the previous 12 months and only four (9%) had attended in the past month. The respondents who had ever attended a rave were then asked follow-up questions about the last time they had attended a rave. About half of those who had attended a rave had used a club drug at that last event. As with club drug use in general, MDMA and LSD were the most commonly used club drugs at the last venue attendance. Respondents who had used a club drug at the time of their most recent rave attendance were asked about other substance use while at that rave/party. Again, corresponding to club drug use in general, alcohol, marijuana and cocaine/crack were the three most commonly used other drugs for venue attendees who used a club drug the last time they attended. Finally, respondents who had used club drugs at their last venue were asked to identify all the reasons why they had used them there. Nearly all (91%) the respondents had used club drugs to 'just get high and

Table 4 Club drug use behavior.

	n	%	95% CI
Rave attendance			
Ever ($n = 125$)	47	37.6	29.5, 46.5
Past 12 months ($n = 47$)	16	34.0	21.6, 49.1
Past 30 days ($n = 47$)	4	8.5	3.1, 21.2
Drug use at last rave ($n = 47$)			
Any club drug use?	23	48.9	34.6, 63.4
MDMA	13	27.7	16.5, 42.6
GHB	0	0.0	–
Ketamine	1	2.1	0.3, 14.5
Rohypnol	1	2.1	0.3, 14.5
Methamphetamine	4	8.5	3.1, 21.2
LSD	14	29.8	18.2, 44.8
Other drugs used at last rave ($n = 23$)			
Alcohol	15	65.2	42.6, 82.6
Marijuana	20	87.0	64.2, 96.1
Cocaine/crack	6	26.1	11.4, 49.1
Heroin	2	8.7	1.9, 31.4
Amphetamines (not MDMA/Meth)	1	4.4	0.5, 28.4
Reason used at rave ($n = 23$)			
To stay up longer	9	39.1	20.6, 61.4
To get into the spirit of the party	16	69.6	46.7, 85.7
To dance more/be more active	13	56.5	34.8, 76.0
Just to get high/enjoy yourself	21	91.3	68.6, 98.1
To enjoy sex more	5	21.7	8.7, 44.8
Any other reason	4	17.4	6.2, 40.3

enjoy' themselves. Similarly, 70% used club drugs 'to get into the spirit of the party'. Over half (57%) used club drugs 'to dance more or be more active'. Only five respondents (22%) reported using club drugs at their last rave/dance party to 'enjoy sex more'.

A related issue concerns the extent to which those who report rave participation differ from other club drug users both demographically and in terms of drug consumption. Bivariate analyses suggested that compared with other club drug users, rave attendees were more likely to be male (66% of rave attendees were male, compared with 46% of non-attendees; $\chi^2_{df=1} = 4.63$; $P < 0.05$). Attendees were also more likely to be younger than the rest of the sample (55%; of rave attendees were between ages 18–25, compared with just 27% of non-attendees; $\chi^2_{df=2} = 13.19$; $P < 0.001$). Rave attendance also appeared to be a marker for more intense club drug involvement, irrespective of whether club drugs were specifically used at the last venue attendance. The rate of club drug use on 10 or more occasions was significantly higher among venue attending club drug users compared to other club drug users. Half of life-time venue attendees reported MDMA use on 10 or more occasions, compared to just 18% of non-rave attendees ($\chi^2_{df=1} = 5.41$; $P < 0.05$).

Table 5 Life-time substance use comparisons: club drug users versus club drug non-users.

	Prevalence/per 100		*Adjusted odds*[1] *Life-time CD users versus CD non-users*	
Substance	*Life-time CD users*	*CD non-users*	*OR*	*95% CI*
Marijuana	99.2	53.9	117.86	16.17, 858.87
Cocaine/crack	62.2	10.8	25.45	13.34, 48.57
Heroin	11.0	1.4	45.94	10.82, 195.12
PCP	19.0	1.2	80.38	22.32, 289.42
Hallucinogens[2]	62.2	3.2	48.69	23.16, 102.37
Inhalants	53.5	8.4	8.25	4.90, 13.89
Stimulants[3]	28.3	3.2	9.84	4.82, 20.12
Tranquilizers	26.6	2.0	12.86	5.59, 29.58
Sedatives	8.3	1.4	5.00	1.53, 16.28
Pain killers	27.5	8.2	4.64	2.50, 8.59

[1]Logistic regression models adjusted for age, race/ethnicity, sex, SES and children in the household. [2]Excludes ecstasy, LSD and PCP. [3]Excludes methamphetamine, desoxyn, and methedrine. All comparisons between proportions are significant at least at the 0.01 level.

Club drug correlates

We have noted that club drug users tend to use other drugs, and often at the same time that they are consuming club drugs. We theorized that club drug users experiment with a wider range of illicit substances than others. Accordingly, we looked at the percentage of club drug users who explored at least three and then at least four other illicit substances in their life-time. The findings clearly suggest more extensive other drug involvement among club drug users compared to the rest of the sample. Among those who reported life-time use of club drugs, 67% reported using three or more other illicit substances, compared with only 7% of those not reporting life-time club drug use ($\chi^2_{df=1} = 222.28$; $P < 0.001$). Over half of life-time club drug users (55%) reported using four or more other illicit substances, compared with only 3% of non-club drug users ($\chi^2_{df=1} = 229.83$; $P < 0.001$).

We followed-up on these findings by looking at the association between life-time club drug use and use of 10 specific non-club drug substances (Table 5). Initial bivariate cross-tabulations were followed-up with logistic regressions adjusting for age, race/ethnicity, sex and the presence of children in the household. Both the bivariate and adjusted findings suggest that compared to others, club drug users consistently reported significantly higher rates of drug use and had significantly increased life-time odds of using all 10 substances. Point estimates for the adjusted odds ratios ranged from 118 (nearly all club drug users reported marijuana use) to just under 5 (for

pain killers). Consistent with this finding, 20% of subjects with a history of life-time club drug use compared with just 5% of the rest of the sample, reported a history of receiving drug or alcohol treatment ($\chi^2_{df=1} = 26.35$; $P < 0.001$). Of the 25 club drug users reporting a history of treatment, 18 (72%) reported receiving treatment for *both* drug and alcohol use.

An emerging literature [11,14,31] suggests that club drugs have particular appeal for gay males. We examined the association between sexual preference and club drug consumption for the sample in general, and within each gender. All subjects were asked the following question:

> Recognizing that sexuality is only one part of your identity, would you consider yourself to be only heterosexual; mostly heterosexual; bisexual; mostly homosexual, lesbian, or gay; or only homosexual, lesbian, or gay?

For the sake of simplification, we collapsed responses into two categories: only heterosexual (92% of the sample) versus all others (8% of the sample; henceforth referred to as 'gay or bisexual'). The rate of life-time club drug use was compared across these two groups for the entire sample. The rate of club drug use among those who were gay or bisexual was 39% compared to 18% for the rest of the sample ($\chi^2_{df=1} = 12.7$; $P < 0.01$). Next, we broke down this classification by gender. Interestingly, we found that the association between sexual orientation and club drug involvement was actually stronger among women than it was in men. Indeed, among gay or bisexual women, the rate of club drug use was 41% compared with 13% for the rest of the women ($\chi^2_{df=1} = 16.9$; $P < 0.001$). The rate in gay or bisexual men was 37% compared with 27% for the rest of the men ($\chi^2_{df=1} = 0.9$; not significant). In other words, significant differences in life-time use rate between the groups according to sexual preference were found among women but not among men.

Club drug risk factors

We examined the association between socio-demographic characteristics and sexual orientation in logistic regression models in order to derive potential risk factors for club drug use that may be informative for targeting intervention/prevention efforts (Table 6). We explored predictors of both life-time and past year club drug use. Significant associations were found between life-time club drug use and race/ethnicity, gender and sexual orientation. Coefficients for age, SES and presence of children in the household were not significant. Compared with white respondents, African American and Hispanic respondents were significantly less likely to report life-time club drug use. Compared with white respondents, African Americans had one-tenth the odds of reporting life-time club drug use (95% confidence interval: 0.05, 0.21) and Hispanic respondents had just over four-tenths the odds of reporting life-time club drug use (95% confidence interval: 0.21, 0.78). Men were significantly more likely to report club drug use than women. Compared with women, men had about 1.7 times the odds of reporting club drug use (95% confidence interval: 1.1, 2.7). Those who classified themselves as gay or bisexual were also significantly more likely to report club drug use; compared with others gay or bisexual respondents had about 2.1 times the odds of reporting life-time club drug use (95% confidence interval: 1.1, 4.2). Weighted and cluster adjusted regression analyses yielded findings similar to those on Table 6. Additional analyses focused on comparing those reporting club drug use in the past year with all others had considerably less power given the low base rate of past year users in the model ($n = 25$). The past year model confirmed only one association from the life-time model. African American respondents had significantly reduced odds of past year club drug use compared with white respondents.

Following-up on our examination of gender differences in the association between sexual orientation and

Table 6 Logistic regression evaluating club drug risk factors ($n = 604$).

	Ever used any club drugs[1]	
	OR	*95% CI*
Age (years)		
18–25	1.09	0.63, 1.87
26–30	1.25	0.72, 2.18
30+	1.00	–
Race/ethnicity		
African American	0.10	0.05, 0.21***
Hispanic	0.41	0.21, 0.78**
Other	0.57	0.28, 1.14
White	1.00	–
Gender		
Male	1.70	1.07, 2.71*
Female	1.00	–
Children in the household		
Yes	0.67	0.40, 1.12
No	1.00	–
Socio-economic status		
Low	0.77	0.31, 1.92
Medium	1.67	0.98, 2.86
High	1.00	–
Sexual orientation		
Gay or bisexual	2.14	1.09, 4.22*
Only heterosexual	1.00	–

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$. [1]Includes MDMA, ketamine, Rohypnol, GHB, LSD and methamphetamine.

drug use, we analyzed an additional model of life-time use that included an interaction term between gender and sexual orientation. As expected, the coefficient for this term was significant and negative, indicating that a significant effect for sexual orientation was apparent for women in the sample but not for men. This finding was also replicated in a weighted analysis adjusted for design effects. In the interaction model, the odds ratio for sexual orientation for women suggested that gay or bisexual women had 4.27 times the odds of reporting club drug behavior compared with other women (95% confidence interval: 1.8, 10.1). By comparison, gay or bisexual men had 0.86 times the odds of reporting club drug behavior compared with other men (95% confidence interval: 0.3, 2.4).

DISCUSSION

This study provides one of the few population-based studies of adult club drug users in the United States. With respect to prevalence, findings focused specifically on MDMA, the drug most consistently assessed in national surveys, our overall rates parallel those obtained in national studies. Nevertheless, our rate of overall club drug use, defined broadly to include a range of substances noted as club drugs by NIDA [21], generated life-time prevalence rates that were twice those obtained from exclusive focus on MDMA.

This study's club drug survey facilitated an exploration of contextual issues in club drug use. Several findings that challenge conventional wisdom conveyed in the popular press should be highlighted. First, despite considerable preoccupation with MDMA, when the full range of possible club drugs was considered in our survey, LSD was just as prevalent as MDMA. That finding held for both life-time and past year prevalence estimates. Secondly, rave attendance, which is associated commonly with club drug use, was not reported by a majority of life-time club drug users. Thirdly, most of those indicating club drug use at a rave did not suggest that their motivation for use was linked directly to the enjoyment of sex. Finally, the association between non-heterosexual sexual orientation and club drug use seemed to be stronger for women than it was for men.

We did not employ a variable measuring number of life-time other illicit drugs used in our risk analysis (Table 6). It should be noted, however, that when this measure was inserted into regression models (i.e. a contrast between those with three or more illicit drugs versus everyone else; data not shown), it remained a highly significant correlate, even after controlling for all other variables shown in Table 5. It is not clear that this measure can be viewed as a 'risk factor' *per se*. This measure, an index of exploratory drug use behavior, is viewed more precisely as a concomitant of club drug involvement. Such exploratory behavior may be an outgrowth of other personality characteristics such as 'sensation seeking' [32]. Future studies attempting to understand club drug use risk better should strongly consider employing one or more of these well established measures of personality.

An important limitation of this study was our low response rate. While the authors have not conducted a systematic analysis of response rate by geographic region within the City of Chicago, the significantly lower response rate in multiple dwelling units characterized by restricted access suggests that high SES respondents were likely to have been under-represented in this study. Because whites are over-represented among those in high SES groups in the United States, and because whites are significantly more likely to use club drugs than others, higher rates of non-response by high SES informants may have lowered the club drug prevalence rate in this study. It is not completely clear how higher SES club drug users might differ systematically from other club drug users. We speculate that under representation of higher SES club drug users in our sample may result in an overestimate of the extent of problematic drug use among club drug users; the extent to which club drug use was associated with polydrug use and history of treatment, for example, may be overstated in this study.

Possible sample bias could also have affected conclusions about risk factors for club drug use, as depicted in Table 6, especially if specific risk factors for MDMA use are related to non-response. To the extent, for example, that 18–25-year-old club drug users are under-represented in this survey, the specific estimates of age effects on club drug use may be understated. For these and other reasons (these data were collected in one Midwestern urban locale), analyses focused on club drug risk factors derived from these data may have limited generalizability and require replication in other population-based studies.

We also acknowledge the possibility that some of our findings may have been the consequence of misinterpretation regarding certain questions within our club drug module. For example, respondents may not have been thinking of specific 'bars' or 'clubs' that are part of the local club scene when they were asked about attendance at raves. In addition, our question regarding the role of club drug consumption in sexual behavior was framed somewhat narrowly, and may not have captured important linkages that require further exploration. Indeed, many of these survey limitations point to the potential need for follow-up qualitative interviews exploring both question interpretation and actual behavior associated with club drug and rave attendance.

Another limitation to note is that our analyses compared club drug users to everyone else in the study. Non-

club drug users were treated as a homogeneous group and subgroups were not analyzed according to their use of or preference for specific non-club substances. In future research we will articulate the myriad of drug use patterns and preferences within this sample and use these analyses as the basis for additional subgroup comparisons with respect to correlates and risk factors.

Any research based on surveys or self-reports needs to address possible limitations in the validity of responses [33]. This study employed biological testing that could detect recent use of at least three club drugs, MDMA, methamphetamine and ketamine. Positive tests for these substances were rare (only three instances) and nearly all recent use data for these substances resulted from survey reports. In other words, with respect to club drug use, survey reports proved far more informative than drug testing. This stands in considerable contrast to relatively high levels of under-reporting observed for cocaine in previous community surveys [33]. It should also be noted that within the context of this study, club drug users tended to be more honest about their drug use than other subjects. Among those testing positive for marijuana by any method, 91% of life-time club drug users disclosed past month use of this substance, compared with 59% of non-club drug users ($\chi^2_{df=1} = 10.86$; $P < 0.01$). Among those testing positive for cocaine by any method, 46% of life-time club drug users disclosed use of this substance during the past month, compared with 10% of non-club drug users (Fisher's exact test, $P < 0.01$). We recommend the continued use of biological testing for club drugs in epidemiological surveys to assess the extent to which our findings can be generalized to other populations and settings. In the meantime, our findings support the viability of gathering data about club drug use via self-reports in community-based surveys.

Rave attendees are demographically different than other club drug users. They are younger and more likely to be male. Rave attendees are also among the highest risk of all club drug users as they use club drugs more frequently. This is consistent with many recent studies emerging from Great Britain and other European countries [34], as well as one recent study of rave attendees in the United States [15]. These results underscore the limitations of epidemiological inferences derived from studies employing samples recruited directly from raves, a design feature of many studies of club drug involvement. Rave attendees may reflect the most drug-involved among all club drug users. It is important to note that given clear behavioral differences between rave attendees and others, studies investigating the consequences and correlates of club drug use need to consider potential biases inherent in singling out rave attendees as subjects.

Club drug researchers might consider sampling a mix of rave attendees and non-rave attendees in order to ensure a more comprehensive and accurate assessment of this behavior and its consequences. Given research suggesting that rave attendance may be more popular among gay males [14,31], we suggest that additional research is needed to explore further findings regarding gender specific effects and sexual orientation. There is little available information regarding club drug use among gay and bisexual women and the findings reported here suggest that further investigation of this issue is warranted.

Raves were not the site of club drug use or club drug acquisition for most subjects who reported use of these substances. On the other hand, venue attendance itself is a marker for more frequent club drug use. Most of those using club drugs at venues also use alcohol and cocaine. Thus, there appears to be a unique risk status associated with rave involvement which needs to be investigated further.

Until now, US public policy has focused efforts on generating sanctions against venue sponsors [35]. Nevertheless, if the results of this study are generalizable beyond the time and place in which the data were collected, it would appear that rave-focused sanctions are misdirected because the nexus of drug use may be outside these venues. Raves may provide a unique opportunity for communicating harm reduction messages to attendees who may be predisposed towards risky behavior and dangerous collateral drug involvement outside the context of the venue. These strategies and messages need to be informed by a careful examination of individual predispositions and social processes that give rise to the risk taking behaviors among those that participate in these events.

With rare exceptions [36], most US epidemiological studies of club drugs have focused exclusively on MDMA [2,5,14]. Our study underscores the potential importance of broadening research on club drugs to include the full range of substances considered here. Our more inclusive definition yielded a relatively high life-time prevalence rate. While high-frequency use of these substances was rare, a considerable range was observed for every club drug type. This finding underscores the importance of research comparing these different club drugs with respect to behavioral and neurocognitive sequelae.

Club drug use patterns found here present something of a paradox. For most club drugs, median life-time use frequency was only three occasions. At the same time, compared with all others in the sample, club drug users tended to show high rates of involvement in multiple illicit substances and an increased rate of drug and alcohol treatment. While club drugs may be seldom characterized by persistent use, users report an overall pattern of high-risk substance consumption. Thus, on a population level, our findings suggest that substance abuse prevention campaigns focused specifically on club drugs may be

problematic. Prevention efforts may need to focus on risk factors for the emergence of high-risk consumption which is reflected in eventual club drug involvement. Future research needs to articulate more clearly such consumption patterns and identify key risk factors which can be successfully targeted.

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